RECLAMATION OF ARID WEST BY FEDERAL GOVERNMENT

By Arthur P. Davis,
Chief Engineer United States Reclamation Service.

When the President approved, on June 17, 1902, a bill known as the Reclamation Act, the United States entered upon a policy of internal improvement along novel lines. Many millions have been spent upon internal improvements, but none of them on a commercial basis, that is, the beneficiaries of the expended funds have never been required to return the cost of the improvements as is required by the Reclamation Act.

The preliminary stage of survey and examination for the selection of projects is now practically passed. The second stage of construction is well advanced and large areas of land have been placed under irrigation. The third stage, that of settling the various projects with prosperous settlers and collecting from them the cost of the works, has just been entered upon. The novelty of this feature, together with other important obstacles constitutes this third stage the most difficult of all.

In all, twenty-six projects have been approved by the Secretary of the Interior and construction has commenced on twenty-five of these, several having been nearly completed. On the passage of the law, a sum of money amounting to nearly $5,000,000 was made immediately available by the terms of the act. During the stage of organization, survey, and examination, the expenditures were relatively light and the fund continued to accumulate under the provisions of the law by the sale of public lands in the West. As construction was undertaken, however, the expenditures increased, and as new projects were taken up the increments augmented until now the accumulated funds have practically been exhausted, and during the future years the outlay will probably be governed by the current receipts from various sources.

Salt River Project, Arizona

About twenty years ago began a series of years of unusually large run-off in the Salt River basin in Arizona. The successive high-water periods, showing a large amount of surplus run-off year after year, attracted public attention and encouraged the construction of canals and development of irrigation until these enterprises reached far beyond the capacity of the river in ordinary years. In 1898, like the backward swing of the pendulum, began a series of unprecedented dry years, the run-off for several years being below the yield during the recollection of the oldest inhabitant.

The hot arid climate makes all crops absolutely dependent upon irrigation in this region, and long-continued drought led to the death of large and valuable orchards, vineyards and alfalfa fields upon which great expenditures had been made. In attempting to save property in all parts of the valley hardship was caused even to the oldest irrigators with the best water rights. Under these circumstances the legislature of Arizona provided for preliminary investigations of the feasibility of water storage on upper Salt River, which were carried out in co-operation with the Geological Survey in 1901. A large and feasible reservoir site was surveyed and a foundation for a dam explored with diamond drills.

Unusual difficulties were presented by the isolation of the locality and the extreme roughness of the surrounding country, which was of a volcanic origin and scored by profound box canyons. Those conditions made it extremely expensive to import large quantities of heavy articles, such as cement and fuel. Investigations revealed the presence of suitable materials for the manufacture of cement at the dam site, but the large quantity of fuel required for the necessary power for manufacturing the cement and building the dam presented great difficulties. The little wood that was available was scattered and of poor quality. It was decided to develop water power by diverting the river and carrying it through canals and tunnels for a distance of about eighteen miles and dropping it about 250 feet. The towns of Phœnix and Mesa co-operated in the construction of a road by issuing over $70,000 in bonds for the purpose. Fuel oil imported from California is freighted from Mesa over this road. This oil is used in the kilns

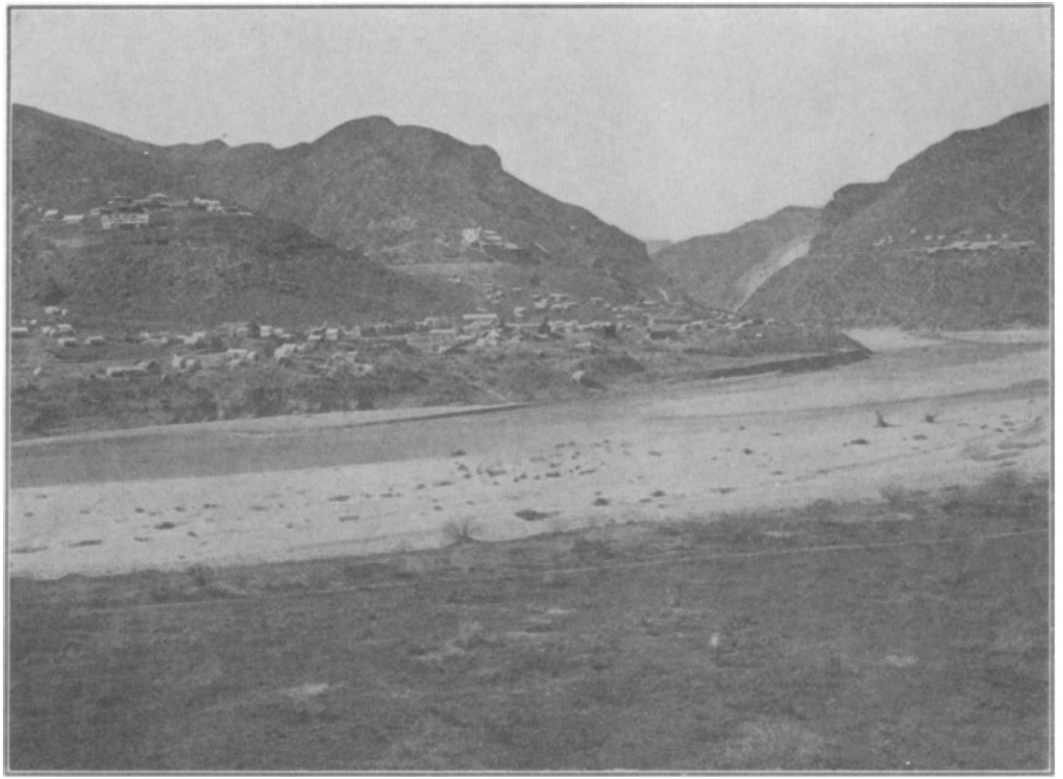

PLATE I.—Roosevelt dam site, looking down-stream. Buildings in upper left, engineers' camp; upper center, cement mill and sand crusher; on the right, contractor's camp; lower bench, temporary town of Roosevelt, which will be submerged when reservoir fills.

for burning cement, and water power is used to run machinery in the cement mill and to handle the rock and mortar for the dam.

The little sand that occurs in this vicinity is badly mixed with adobe mud and is of very poor quality. It was found that a much higher grade of sand could be manufactured by crushing dolomite, which occurs conveniently near the dam site, and a mill was erected for this purpose. In the foundations of the various mills and buildings large quantities of lime were used, which were also burned at the dam site. Such works as those always require large quantities of lumber for concrete forms and temporary works of various kinds. It was found feasible to install a saw-mill in the neighboring mountains for this purpose, and about 3,000,000 feet of lumber have been sawed and delivered upon the work.

The dam on Salt River is to be built just below the mouth of Tonto Creek, where the river flows through a profound gorge. From foundation to coping the dam will be about 280 feet high, and the reservoir will have a capacity of about 1,300,000 acre feet. The power developed for the construction of the dam will, after its completion, be transferred to the valley for pumping water from wells to increase the water supply for irrigation. Arrangements have also been made for transferring a portion of this power to the Gila River Indian Reservation for supplying the Indians with irrigation water by pumping.

The contract for this dam was let to James O'Rourke and Company, of Galveston, Texas, in April, 1905. Since the contractor began work an unprecedented series of excessive floods have greatly hampered the work, having washed out the contractor's coffer-dam four successive times and filled up excavated portions of the foundation. The contractor has, however, succeeded in placing the foundation in the river and bringing the upstream portion of it to the top of his coffer-dam, so that such disasters are not to be feared in the future.

The great flood of November, 1905, also washed out the Arizona Dam, just below the mouth of Verde River, which served as a diversion dam for the Arizona Canal and the other canals on the north side of Salt River. This north-side system was purchased by the Secretary of the Interior with reclamation funds in 1906, and a concrete dam for diverting water into it is being constructed at a granite reef, below the old Arizona Dam. The

entire canal system on the north side of Salt River, serving at present over 60,000 acres of land, is being operated by the reclamation service, a temporary dam being maintained in the river at the head of the canal, pending the completion of the concrete structure below.

The storage system under construction is expected to serve an area of 180,000 acres of land in this valley, which can be increased by the extension of pumping development with the power available from the project until the limit of the underground water supply is reached. The reservoir dam is 25 per cent completed. The Granite Reef Dam is 38 per cent completed. The Salt River project as a whole is 62 per cent completed.

Yuma Project, Arizona-California

The Yuma project provides for the construction of a diversion dam across Colorado River about ten miles northeast of Yuma, Arizona. From this diversion dam two canals will be built; the one in Arizona to cover about 83,000 acres of land, and the one in California, about 17,000 acres. The project provides for an efficient means of sluicing out the head of the canal by utilizing the fall secured by the dam. The dam will have a total length of 4,780 feet, a maximum width of 257 feet, and a maximum height of 19 feet. The work on the dam was begun July 20, 1905; but the contractors made slow progress and it was finally taken up by the government under force account.

One of the chief difficulties encountered was the transportation of fuel and other supplies from the railroad to the dam site. The roads were very bad and the navigation of the river so poor that it was frequently impossible to keep the machinery supplied with fuel. It is now the intention to build a railroad from the main line of the Southern Pacific to the dam site on the California side of the river. As soon as this is completed, work will be actively pushed on the dam, and it is expected that some water will be turned into canals in 1908, though the full season's supply cannot be furnished until 1909.

Orland Project, California

The Orland project contemplates the storage of water in the foothills on the headworks of Stoney Creek and its diversion and

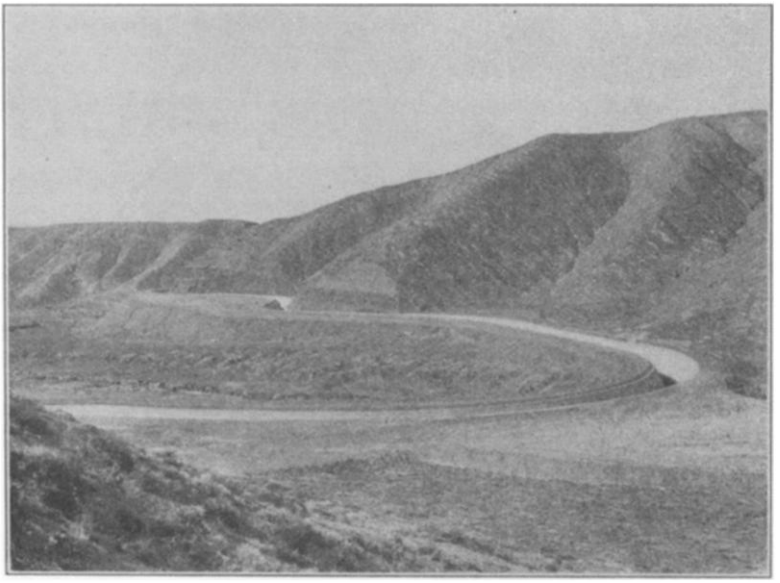

PLATE II.—Main south canal, Uncompahgre Valley. Lined canal section through clay foothills.

use in the vicinity of the town of Orland, California. Options have been obtained for the rights of way necessary on the reservoir site and also for the two existing ditches near Orland. Negotiations are completed with the Central Canal and Irrigation Company, for the amicable adjustment of claims to the waters of Stoney Creek, which will remove all complications of this nature. Prospects are good for the beginning of active construction during the year 1908 for the irrigation of about 15,000 acres of land. The project, however, is susceptible of considerable extension beyond this point by the utilization of other reservoir sites and by pumping water from the underground supply. This project is regarded as an integral part of the general development of the Sacramento Valley.

Uncompahgre Valley Project, Colorado

The Uncompahgre Valley in Colorado has been irrigated for many years, and the development of irrigation has proceeded beyond the available water supply of the Uncompahgre River, some of the waters originally appropriated having been diverted by later ditches in the valley above. To relieve this condition, and also to bring under irrigation a large area of land in the valley still unwatered, the Reclamation Service undertook the construction of a tunnel through the mountain range to bring water from the Gunnison River into the Uncompahgre Valley. The length of the tunnel is 30,515 feet, and the works include a number of small tunnels and a great deal of heavy construction in canals through rough country.

The contract for the construction of the main tunnel was let, in 1904, to the Taylor-Moore Construction Company, but financial difficulties caused its abandonment by the contractor on May 27, 1905. Since that time it has been prosecuted by day labor under the engineers of the Reclamation Service. The work has presented a great many difficulties. For a considerable distance the western half of the tunnel follows almost directly under the bed of Cedar Creek, which is composed of loose sand, gravel and mud. In May, 1905, this channel broke through the contractor's temporary timbering, causing an extensive cave-in and resulting in the death of six persons. In August, 1907, Cedar Creek broke through the lining of the tunnel at two different times and places, bringing in large quantities of mud, sand, and gravel, and causing delay to the

work. No one was injured by these accidents, however. On December 22, 1906, the drills in the west heading struck a strong flow of water under high pressure, discharging about seven cubic feet per second, and heavily charged with carbon dioxide. The gas quickly filled the tunnel and drove the men out. In order to properly ventilate the tunnel thereafter it was found necessary to sink a shaft near the heading, which involved a shaft of about 700 feet. The work was greatly delayed from this cause, but the water was drained out and the tunnel was cleared of gas so that work was again resumed. Smaller quantities of gas have from time to time been struck in various parts of the tunnel, causing danger and delay, but no lives have been lost thereby. On July 16, 1907, a heavy flow of water was encountered at the eastern heading, which flooded the machinery and drove the men from work. It was more than a month before work could be resumed at this heading. Large quantities of water have been encountered from time to time in both headings, always causing delay and heavy expense. On November 30 the progress of excavating this tunnel was as follows:

East heading	7,933 feet
West heading	14,338 "
Total	22,271 feet
Lining (tunnel complete)	7,781 feet
Distance between headings	8,244 "

The Uncompahgre Valley project was, as a whole, 74 per cent complete on the above date.

Minidoka Project, Idaho

The Minidoka project diverts water from Snake River near the station of Minidoka, Idaho. About 60,000 acres on each side of the river will be irrigated from this diversion point and the canal system for the north side has been completed. A portion of the lands on the south lie above the possibility of gravity distribution, and require the construction of a large dam and the development of power which can be made available at the dam site. The dam was constructed by the Bates and Rogers Construction Company, and is about fifty feet high. Water from this system was deliv-

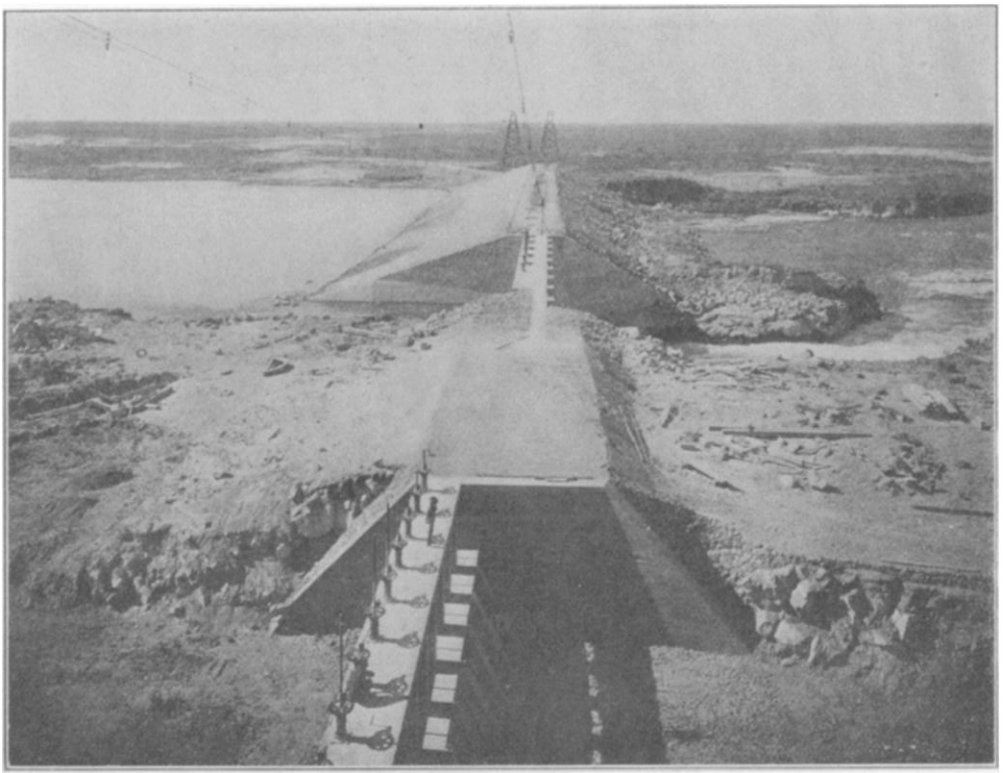

PLATE III.—Minidoka Dam, looking south. Diversion dam on Snake River, 50 feet high, showing towers and cableways, from which rock was placed. Gates of north side canal in foreground. Power units will be installed in the bays in main dam to develop about 10,000 horse-power from the water passing through to supply prior rights below.

PLATE IV.—Huntley canal, looking east. Opened by Secretary Garfield, June 26, 1907. Town of Huntley in the distance.

ered in May to a portion of the land, and about 18,000 acres have been actually cultivated. All the public land for which water is available has been taken and extensive improvements have been made by settlers.

Payette-Boise Project, Idaho

Payette-Boise project provides for the storage of waters of both the Payette and Boise Rivers by storage reservoirs on each stream. The land to be reclaimed is mainly in the Boise Valley, and a large portion of the waters of Payette River are to be brought into the Boise Valley. The unit now under construction involves a dam on the Boise River, which is more than half completed. A large canal will conduct water from this point for storage to a basin known as the Deer Flat reservoir. Two large earthen embankments are required to form the reservoir basin. These embankments are under construction, one by contract and the other by force account. Satisfactory progress has been made, and it is expected that this unit will be completed in 1908.

Garden City Project, Kansas

The Garden City project will obtain water for irrigation by pumping from underground. For this purpose a power plant has been constructed at Deerfield, Kansas, consisting of steam turbines driving electric generators from which the power is delivered to twenty-three separate pumping stations, which will supply water to about 8,600 acres, situated in the vicinity of Garden City. The power plant is practically completed and some of the pumping stations are ready for tests. Water will be furnished to most of the land during 1908, the old existing canal system being used for this purpose.

Huntley Project, Montana

The Huntley project provides for the diversion of water from the Yellowstone River at a point about three miles above Huntley, Montana, on the south bank. The canal and tunnels necessary for this diversion have been constructed to cover more than 20,000 acres of land, and the project as a whole will include about 30,000 acres, twelve miles from the source of the canal. There is a great

deal of side-hill work which is very difficult and expensive, and it is found necessary to drop the water to a lower level for the major portion of the lands. The power generated by this fall is used to pump a portion of the water to a higher level to command lands on the top of the mesa. This pumping plant has been completed and will be in operation in 1908. The lands to be reclaimed form a portion of the area which the Crow Indians by treaty ratified by Act of Congress approved April 27, 1904, ceded to the United States. They were formally opened to settlement on June 26, 1907, and a considerable number of entries have been made for which water will be delivered in 1908.

Sun River Project, Montana

The Sun River project provides for the irrigation of a large acreage on both sides of Sun River and the construction of a number of reservoirs for regulating the waters. The first unit, authorized in March, 1906, is now under construction and will irrigate about 18,000 acres in the vicinity of Fort Shaw, for which water will be regulated in a small reservoir on Willow Creek. The main canal for the Fort Shaw unit is under construction and work has been begun on the lateral system. The outlet tunnel and other preliminary work on the Willow Creek reservoir are almost completed. It is expected that a small acreage of land under this unit will be offered for settlement in 1906.

North Platte Project, Wyoming-Nebraska

The North Platte project involves the construction of a reservoir on the North Platte River about fifty miles above Casper, Wyoming, to hold the winter and summer flood waters for use during the low-water period of the late summer, the normal flow of the late summer having been already appropriated and applied to beneficial use by farmers on the lower river, mainly in Nebraska. The reservoir, which has been named the Pathfinder, will have a capacity of 1,000,000 acre feet, and the dam will be about 200 feet high. The contract for this construction was let to the Geddes and Seerie Stone Company, in 1905, and is 40 per cent completed. The contractors are making very satisfactory progress and doing excellent work. It is expected that the dam will be completed

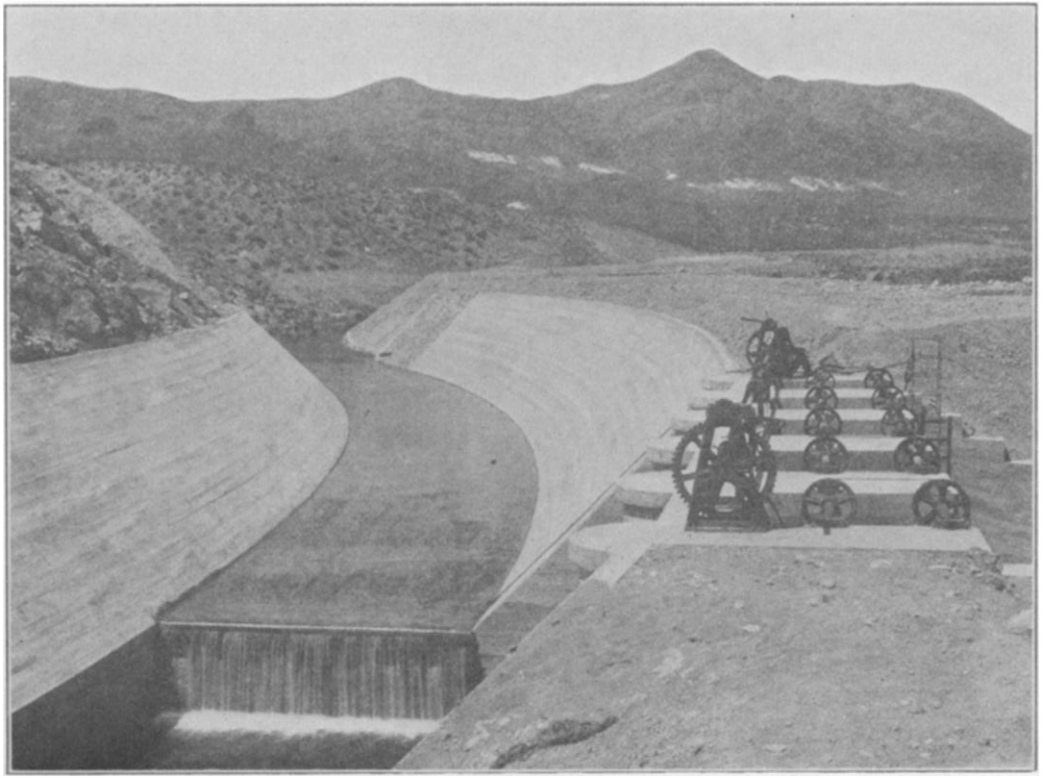

PLATE V.—Wasteway of Truckee main canal, Truckee-Carson project, Nevada.

about the end of 1908. The water stored in the Pathfinder reservoir will be diverted for irrigation at various points on the lower river and both sides of the line between Wyoming and Nebraska. At present a diversion dam is under construction by the S. R. H. Robinson and Son Construction Company, near the station of Whalen, Wyoming, on the Burlington road. Satisfactory progress has been made with this dam and it will be completed early in 1908. From this point a canal, with a capacity of 1,400 cubic feet per second, has been constructed and nearly completed to a point about 100 miles eastward, situated nearly northeast of Scottsbluff, Nebraska. This canal at present covers nearly 30,000 acres in Wyoming, and about 75,000 acres in Nebraska, 40,000 of which it is expected will be ready for irrigation in the year 1908. Water was turned into the canal May 5, 1906, and was used for irrigation during that summer upon certain tracts in Wyoming. Its use has been extended during the past season. Construction is being pushed upon the distribution system, and it is expected that over 40,000 acres can be irrigated in Nebraska the next irrigation season.

Truckee-Carson Project, Nevada

The Truckee-Carson project consists of the diversion of waters of Truckee and Carson Rivers upon the adjacent lands, mostly lying in the lower Carson basin. The Truckee waters are carried by a large conduit of 1,400 second feet capacity to the Carson River, a small amount of the water being distributed upon the divide between these rivers. A large diversion dam in the Carson River has been constructed and the water is carried through a large canal to the land south of the Carson River, a small area on the north side being commanded also by a smaller canal. At present 100,000 acres of land are ready for settlement and about 30,000 acres are actually under cultivation. Lake Tahoe will be used as a storage reservoir to serve this project. With the regulation accomplished by this reservoir it will be possible to irrigate about 150,000 acres of land. Several other reservoirs are also contemplated, which will greatly extend the area to be covered. Considerable vacant land on this project is now under irrigation and available for homestead entry under the Reclamation Act.

Carlsbad Project, New Mexico

The Carlsbad project was constructed by private enterprise in the early '90's, but was not successful, either physically or financially. After contending with washouts and various other disasters, the proprietary company in 1905 found itself unable to replace the Avalon dam, which was destroyed by a flood in 1904, and upon which the canal system depended for its supply. The property was transferred to the United States and the Reclamation Service undertook its rehabilitation. Water was delivered to a portion of the lands in May, 1907, and about 20,000 acres will be placed under irrigation in 1908.

Hondo Project, New Mexico

The Hondo project, now practically completed, provides for the diversion of waters of Hondo River into a basin constructed to the north of the river from which the stored waters will be discharged into the channel of the Hondo River below, and diverted upon lands in the vicinity of Roswell, New Mexico. This project contemplates the reclamation of 10,000 acres of land, and some water may be delivered for irrigation in 1908.

Rio Grande Project, New Mexico-Texas

The Rio Grande project contemplates the construction of a large storage reservoir between San Marcial and Engle stations on the Santa Fé Railroad. This reservoir will have a capacity of about 2,000,000 acre feet, and will be ample to completely regulate the entire flow of the Rio Grande at this point. The stored waters will be diverted at various points below to irrigate about 180,000 acres of land, a small portion of which is now under cultivation, with a very uncertain water supply, from the natural flow of the river. By treaty with Mexico 60,000 acre feet of this water will be delivered annually at the head of the Mexican ditch near El Paso for use upon the Mexican side. For this reason Congress made a direct appropriation of $1,000,000 for the payment of a portion of the expense of this project, which is estimated to cost about $8,000,000. A diversion dam is now under construction and nearing completion in the vicinity of Fort Selden, which will divert the unregulated waters into existing canals. The dam will be of concrete and will be ready for service in 1908. Only preliminary work has yet been done upon the reservoir.

PLATE VI.—Outlet tower, Hondo reservoir, New Mexico.

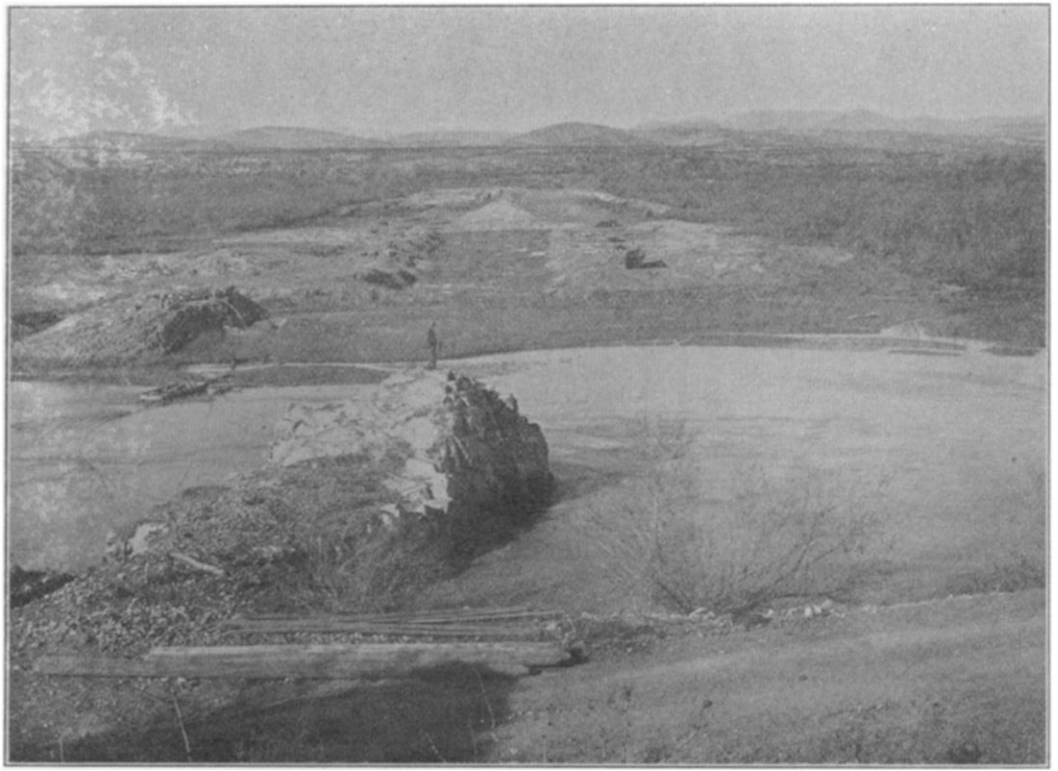

PLATE VII.—Site of Leasburg Diversion Dam on Rio Grande. Under construction. Canal gates will be set in Penasco Rock in foreground. Concrete dam will extend from Penasco Rock to join embankment in distance.

Lower Yellowstone Project, Montana-North Dakota

The Lower Yellowstone project will irrigate lands on the left bank of the Yellowstone River, beginning at a point about twenty-five miles below Glendive, Montana, and extending to the junction of the Yellowstone and Missouri rivers. The river will be diverted by a timber and stone dam about twenty miles below Glendive, and the canal will be constructed in heavy cut for several miles eastward from this point until it emerges on the surface of the ground. The project will irrigate about 70,000 acres of land, about two-thirds of which is in Montana and one-third in North Dakota. It involves much heavy construction and includes one direct pumping plant where the power, generated by water falling from the canal to the level of the bottom lands, will be utilized to lift a portion of the water to a bench above the canal and cover about 3,000 acres of additional land. Construction on the main canal is in an advanced stage and a large number of the laterals are nearing completion. It is expected that water will be delivered to a large portion of the land some time in 1908.

Buford-Trenton and Williston Projects, North Dakota

Two pumping projects are under construction on the left bank of the Missouri River which will develop power by the use of the lignite which occurs in the vicinity.

At Williston a large power station has been constructed at the mouth of the lignite mine, and power is transmitted to a pumping plant on the river near Williston and to another pumping plant at Buford. From these pumping plants the water will be discharged in canals to valley lands from Buford to Williston. These pumping plants are in an advanced stage of construction and will be ready to deliver water some time in 1908.

Klamath Project, Oregon-California

The Klamath project is an interstate project involving the reclamation of lands in Oregon and California in the vicinity of Klamath Falls, Oregon, by the use of the waters from upper Klamath Lake and of Lost River. A large canal from upper Klamath Lake to Lost River has been completed by contract, and water was delivered in the past season to lands along its course. The power canal on the right bank of Link River is being constructed,

which will furnish power for local use and supply the needs of the company whose enterprise will be superseded by the government canal. This canal will be extended to the right bank of the Klamath River.

Umatilla Project, Oregon

The Umatilla project diverts the water from Umatilla River and carries it through a long conduit to a reservoir near Cold Springs, formed by building a dam across a dry ravine. The headworks and feed canal have been constructed under contract, and work by force account is being vigorously pushed upon the Cold Springs dam. It will be an earthen structure, and the reservoir will have a capacity of 50,000 acre feet. Work is also being pushed on the outlet canal and distribution system and it is expected that a small acreage can be irrigated during the coming season, although it will be impossible to complete the project before 1909.

Belle Fourche Project, South Dakota

The Belle Fourche project utilizes the waters of Belle Fourche River by diverting them at a point near the town of Belle Fourche and carrying them to a reservoir, to be constructed on Owl Creek at its junction with Dry Creek. The diversion dam and a feed canal, both of which are large structures, have been completed, and work is being carried on under contract on the large earthen dam across Owl Creek. Extensive work has also been done on the main canal and the distribution system. Some land will be placed under irrigation in 1908 and is now ready for settlement.

Strawberry Valley Project, Utah

The Strawberry Valley project provides for a storage reservoir on Strawberry Creek, a tributary of Duchesne River, Utah. The stored water will be carried through a tunnel about four miles in length, discharging into Diamond Creek, a tributary of Spanish Fork River. The water will be delivered from the Spanish Fork and utilized upon about 40,000 acres of land in the vicinity of the town of Spanish Fork. Preliminary work for this project is under way. The western end of the tunnel has been opened up and a power plant is being constructed for the development of

electric power for construction in the tunnel. The canal used for this power plant will also be utilized for the conduction of the waters to the irrigable lands when these are available. It is expected that the power plant will be completed and active work begun on the tunnel in the spring of 1908. The project, however, will require several years for its completion. In the meantime the canal system can be used for delivering the flood waters of Spanish Fork to the lands which will later receive a full supply.

Okanogan Project, Washington

The Okanogan project in northern Washington provides for the storage of water on Salmon River and its diversion at a point lower down to cover bench land lying between Alma and Riverside on Okanogan River. Work is now in progress on the Salmon Lake reservoir and also on the canal system, and is being vigorously pushed by force account.

Sunnyside Project, Washington

The Sunnyside Canal system of the Washington Irrigation Company was purchased by the Secretary of the Interior, and is being enlarged and improved for the better service of a larger area of land. The old wooden headworks have been removed and permanent works of concrete of larger capacity have been built. The diversion dam partly washed away during the flood in the spring of 1907, and a permanent dam of concrete is being built in its place. It is expected that this dam will be completed the present autumn. The wasteway below Zillah is being reconstructed and put in safe condition to carry the water of the canal when repairs or other emergencies render this necessary. The water for the extension of irrigation under this system will be provided by storage in Lakes Kachess, Keechelus, and Clealum, on the headwaters of Yakima River. Temporary controlling works have already been installed at the two former points and permanent dams below the lakes will eventually be built.

Tieton Project, Washington

The Tieton project receives its water supply from the Tieton River, northwest of the City of North Yakima, and carries it along the canyon wall and over the divide into the Cowiche Basin,

where an area of about 30,000 acres can be commanded. The work in the canyon is very heavy, requiring side-hill canyon in rock and a large amount of tunneling. This work is now under way, the excavation and tunneling being done by the government under force account and the canal lining under contract. The power plant for excavating these tunnels has been constructed on the Tieton River and is now in operation, furnishing power to the drills and ventilating machinery. The canal system in Cowiche Valley is under survey and will soon be ready for construction. The waters utilized for this project are appropriated lower down from the Naches River into which the Tieton flows. The water to be diverted from the Tieton will be supplied to the prior appropriators on the Naches by storage in Bumping Lake reservoir, the construction of which will be undertaken next year.

Shoshone Project, Wyoming

The Shoshone project contemplates the storage and complete control of the waters of the Shoshone River by the construction of a dam 310 feet high, eight miles above Cody, Wyoming. The contract for the construction of this dam was let to Prendergast and Clarkson in 1905, but this firm failed and their bondsmen, the United States Fidelity and Guaranty Company, executed a contract with the Secretary of the Interior for the construction of the dam. Temporary diversion works have been completed and the contractor is engaged upon excavating for the foundation of the dam. The work has been delayed by washout of the temporary diversion works, but these have been restored and things are in shape for pushing the work rapidly. The reservoir to be formed will have a storage capacity of about 420,000 acre feet. The water will be allowed to flow down the river and diverted at various points, the principal one being at the Corbett Dam, which is under contract and nearly completed. From this diversion dam water flows through the tunnel known as the Corbett tunnel, about 18,000 feet in length, and emerges on top of the mesa. This tunnel was originally under contract, but the contractor failed and the work was completed by the government on force account. The canal system is now under construction by contract, and it is expected that water will be ready for delivery to about 15,000 acres of land in May, 1908, between the stations of Ralston and Garland along the Bur-

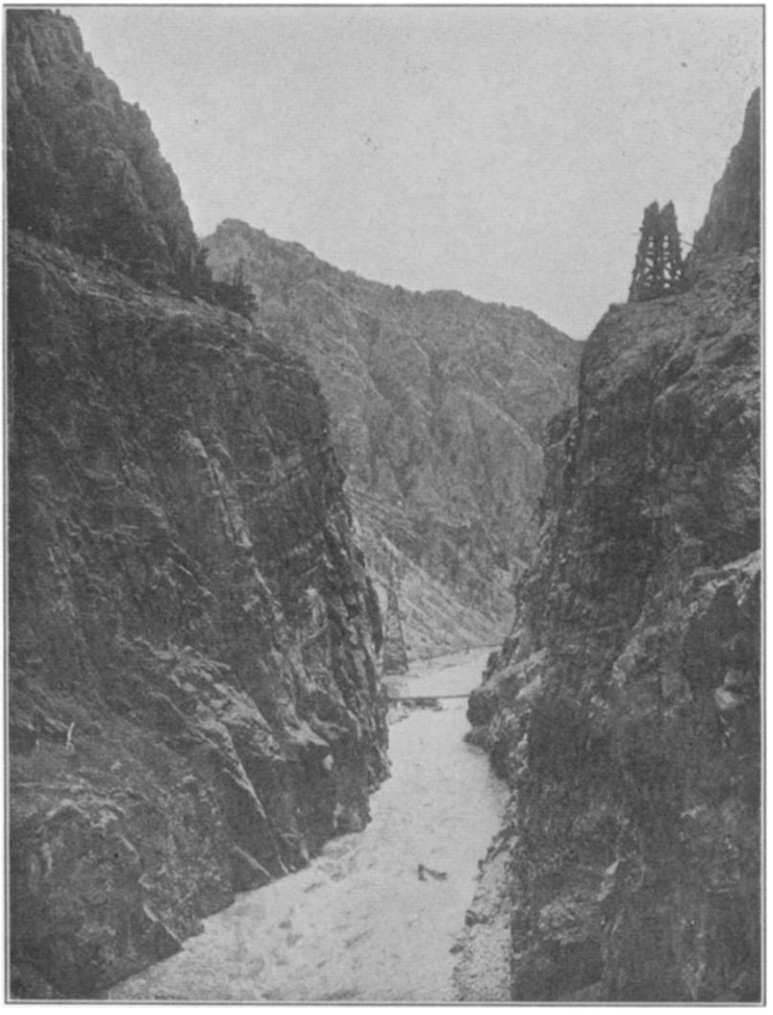

PLATE VIII.—Site of Shoshone Dam, Wyoming, looking up-stream. Under construction. Height from foundation to coping 310 feet. It will be the highest dam in the world.

lington Railroad. Additional areas will be covered by the distribution system and placed under irrigation as settlement demands.

The total amount expended from the Reclamation Fund to December 31, 1907, is $33,300,000. The amount available for expenditure during the calendar year 1908 is approximately $7,000,000. The projects now approved and in process of construction, with the irrigable acreage which will be placed under cultivation within the next few years, are as follows:

Project.	Estimated cost.	Irrigable acreage.
Salt River, Arizona	$5,300,000	200,000
Yuma, California-Arizona	4,500,000	100,000
Orland, California	1,500,000	30,000
Uncompahgre, Colorado	6,200,000	140,000
Grand River, Colorado	2,500,000	50,000
Minidoka, Idaho	2,000,000	80,000
Payette-Boise, Idaho	3,600,000	120,000
Garden City, Kansas	320,000	8,000
Huntley, Montana	900,000	30,000
Sun River, Montana	500,000	16,000
North Platte, Nebraska-Wyoming	4,100,000	118,000
Truckee-Carson, Nevada	4,500,000	150,000
Hondo, New Mexico	336,000	10,000
Carlsbad, New Mexico	600,000	20,000
Rio Grande, New Mexico	200,000	10,000
Lower Yellowstone, Montana-North Dakota	2,700,000	67,000
Buford-Trenton and Williston, North Dakota	1,000,000	30,000
Klamath, Oregon-California	1,400,000	50,000
Umatilla, Oregon	1,140,000	20,000
Belle Fourche, South Dakota	3,400,000	100,000
Strawberry Valley, Utah	1,350,000	35,000
Okanogan, Washington	500,000	9,000
Tieton, Washington	1,400,000	24,000
Sunnyside, Washington	2,000,000	50,000
Wapato, Washington	600,000	20,000
Shoshone, Wyoming	4,500,000	100,000
Total	$57,046,000	1,587,000

Some of the above projects are capable of greater extension beyond that indicated above. In addition to this a number of large projects have been investigated and found feasible, but not

yet taken up. No detailed estimate of acreage or cost has been made of such projects, but the following table shows a rough approximation on these points:

Projects.	Estimated acreage.	Probable cost.
Little Colorado, Arizona	80,000	$ 4,000,000
Sacramento Valley, California	500,000	20,000,000
San Joaquin Valley, California	200,000	8,000,000
Colorado River, Colorado, Utah, California, Arizona	750,000	40,000,000
Dubois, Idaho	100,000	4,000,000
Lake Basin, Montana	300,000	12,000,000
Las Vegas, New Mexico	35,000	2,100,000
Urton Lake, New Mexico	45,000	2,000,000
Walker and Humboldt Rivers, Nevada	500,000	15,000,000
Red River, Oklahoma	100,000	4,000,000
John Day River, Oregon	200,000	10,000,000
Weber, Utah	100,000	5,000,000
Big Bend, Washington	750,000	30,000,000
Goshen Hole, Wyoming	120,000	5,000,000
Totals	3,780,000	$161,100,000